The role of research competences in acquiring competences for sustainable development. An integrated view to support and strengthen the transition towards education for sustainable development.

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Abstract

Within the field of integrating sustainable development in higher education, particular attention is given to the definition of key competences for sustainable development, and the implications their integration imposes towards higher education. The acquisition of key competences should be enabled in student-centered, participatory and active learning methods. Often, research-based methods are mentioned to contribute to this process as well, though from a general perspective, or from the sidelines of the learning process. This paper explores the specific link between competences for sustainable development and research competences. It looks at the current debate on research competences and the way they are defined, interpreted and integrated within a Belgian higher education institution. The paper discusses the current problems of the competence concept, and the possible contribution of research competences and research-based education to acquiring competences for sustainable development. It concludes with specific recommendations to further strengthen the integration of competences for sustainable development.

Keywords: *competences for sustainable development, research competences, education for sustainable development, higher education*

1. Introduction

This paper focuses on two specific areas in the concept of competence-based and competence-oriented education: “competences for sustainable development” and “research competences”. Competences for sustainable development were defined, starting from the idea that the complexity of current and future societal problems cannot be addressed using classical education models, which focus on knowledge transfer (Wiek et al., 2011). The way competences for sustainable development

are integrated was examined and described in different settings (e.g. Cortès, 2010, Lambrechts et al., 2010, 2012, Segalàs et al., 2009). As many authors point out, there should be a strong emphasis on system thinking, future thinking and the ability to deal with uncertainties (De Haan, 2006, Rieckman, 2012, Roorda, 2010, Sleurs, 2008, Wiek et al., 2011), however, these competences remain poorly integrated in our education system (e.g. Lambrechts et al., 2012).

Moreover, methods and techniques to acquire these competences for SD were described. Lambrechts et al. (2012) distinguished three methods: (1) interactive and participative methods, (2) action oriented methods, (3) research based methods. Research competences and research-based education methods could create a relevant contribution to the acquisition of competences for SD.

This paper elaborates on the specific link between research competences and competences for SD. It starts from the general competence concept in section 2, and the problems occurring with this specific type of education. Section 3 focuses on key competences for SD, their definition and integration, and the implications this imposes to higher education pedagogies. Section 4 elaborates on the role of research-based learning methods and competences, and the position of these concepts towards competences for SD. Section 5 presents a case from Leuven University College (KHLeuven), a Belgian higher education institution (HEI). This section looks at research competences, with a focus on both forms: (1) 'instrumental' research skills, focused on learning and doing research, and (2) research competences focused on acquiring a critical and reflective 'attitude'. Section 6 discusses the way research competences can contribute to the acquisition of competences for SD, hence contribute to the transition towards sustainable higher education. Section 7, based on the results of the case and the discussion, concludes with specific recommendations to further integrate and strengthen competences for SD and research competences.

2. The problem of competences

Over the past years particular attention has been given to competence-based and competence-oriented education. Different policy frameworks were developed and competences were defined, translated and integrated into higher education programs. In an attempt to make (higher) education more relevant towards the labour market, the focus was set on the acquisition of integrative competences rather than isolated (instrumental) skills and (disciplinary) knowledge (De Kraker et al., 2007). The integration of the competence concept in higher education has led to a lot of discussion about the definition of competences, however it seems that a general consensus has been reached in the literature about the features of competence-oriented education: (1) the integration of knowledge, skills, values and attitudes, (2) learning based on projects, cases and problems, and (3) a stronger emphasis on independent learning (Rychen and Salganik, 2003, van Merriënboer et al., 2002).

Competence-based and competence-oriented education is getting widespread in different educational and professional settings, and for different reasons (van Merriënboer et al., 2002):

1) competences in education as "window dressing";

2) integration of competences, oriented towards an innovation in didactics (e.g. problem based education, project based education, integration of knowledge and skills);
3) oriented towards strengthening the relation between education and labor market;
4) integrated approach: a combination of the second and third form.

Despite the general consensus in the theory about competences, there is still a lot of discussion on the practical implementation of competences in existing educational systems. Some authors mention the danger of making higher education too instrumental, when competences are integrated with a strong focus on skills rather than a holistic approach of knowledge, skills, values and attitudes (see e.g. Hermans, 2007, Lambrechts et al. 2009, 2012, Mochizuki and Fadeeva, 2010), or simply when the competence concept is interpreted inadequately (Lotz-Sisitka and Raven, 2009, cited in Mochizuki and Fadeeva, 2010).

This discussion is further complicated by the fact that there are several meanings attributed to the competence concept in different sectors and contexts. Labor organisations interpreted the competence concept in a different way than the (higher) education field. This isn't necessarily problematic, as it is not unusual a given concept is defined and integrated in different contexts, but over the years the different meanings and interpretations were used interchangeably and the discussion became blurred. It is clear that the competence concept has become (too) elastic (van Merriënboer et al., 2002), which has consequences for the implementation of competences in education and the use of instruments for competence-oriented education.

3. Competences for sustainable development

3.1. Competences for SD as a starting point for sustainable higher education

In order to prepare students to cope with complex challenges, take action and achieve sustainable societies, there's a need to rethink the mission of universities, and reorient education, research, outreach and operations. Opinions about the way how to do this range from a simple "add-on" to the existing curriculum, to a complete transition towards sustainable education. Sterling (2004) describes different levels of change, going from no or weak change in level 0, to a complete transformation in level 3. Cotton et al. (2009) point to the importance of so called "second-best solutions" for integrating SD within the current framework of higher education. Other authors (Mochizuki and Fadeeva, 2010, Sleurs, 2008) point out that the integration of competences for sustainable development into higher education, could be a first stepping stone towards sustainable education and serve as a basis for a change in curriculum and higher education pedagogies.

Table 1. Levels of change (Sterling, 2004)

	Level 0	**Level 1: Accomodation**	**Level 2: Reformation**	**Level 3: Transformation**
Type of change	No or weak change	Green gloss	Serious reform	Whole system redesign
Type of learning	Ignorance or denial (no learning)	Adaptive	Critically reflective	Transformative
Response	Rejection or minimum	'Bolt-on'	'Build-in'	Rebuild or redesign
Effect on ESD	No change	Cosmetic reform	Serious greening	Wholly integrative
State of education	As usual	Education *about* sustainability	Education *for* sustainability	Sustainable education

Competences for sustainable development exist in various forms, definitions, settings and interpretations. Several authors defined these competences (e.g. De Haan, 2006, Jucker, 2011, Roorda, 2010, Rieckmann, 2012, Sleurs, 2008, Wiek et al., 2011), offering a complete set of knowledge, skills, values, and attitudes, necessary to ensure that graduate students are able to cope with the complexity and uncertainty of sustainability issues. De Haan (2006), Rieckmann (2012) and Roorda (2010) defined key competences for SD, applicable for all disciplines and study programs. Although all sets of key competences for SD contain comparable aspects, Rieckmann (2012) comprises the most complete and up-to-date list of key competences:

- Competency for systemic thinking and handling of complexity
- Competency for anticipatory thinking
- Competency for critical thinking
- Competency for acting fairly and ecologically
- Competency for cooperation in (heterogeneous) groups
- Competency for participation
- Competency for empathy and change of perspective
- Competency for interdisciplinary work
- Competency for communication and use of media
- Competency for planning and realising innovative projects
- Competency for evaluation
- Competency for ambiguity and frustration tolerance

The defined sets of key competences for SD provide a common and explicit framework to work on the integration of SD in higher education, however they could be characterised as what Wiek et al. (2011, p. 204) call "laundry lists of competences", being too fragmented and missing the interlinking between competences. Furthermore, in addition to this key competences for SD, a disciplinary translation is needed to ensure these general competences are integrated in current study programs (Roorda, 2010). This translation has been made for several disciplines, e.g. for teacher training (Sleurs, 2008), social work (Peeters, 2010) and Ecodesign (Verhulst en Van Doorselaere, 2012).

3.2. The integration of competences for SD in higher education

The integration of competences for SD has been assessed within different settings and study programs, by analysing the competence schemes of study programs and/or policy documents (e.g. Cortés et al., 2010, Lambrechts et al., 2009, 2010, 2012, Segalàs et al., 2009). Taking the limitations of this type of analysis into account, these studies provide useful information about the current status of integration of key competences for SD in certain study programs.

Lambrechts et al. (2010) reported about the integration of competences for SD in 14 study programs in Leuven University College (KHLeuven). Based on this research, a comparable study was made for the bachelor programs in management of both KHLeuven and Hogeschool-Universiteit Brussel (HUBrussel), reported by Lambrechts et al. (2012). The analysis showed that competences related to responsibility and emotional intelligence are available within the competence schemes, although they are fragmented and too implicit. Competences related to system thinking, future orientation, personal involvement and action skills are virtually absent. Overall, both studies pointed out that competences for SD are integrated in an implicit and fragmented way, and that there is a need to frame these competences within the concept of SD. This results in a situation where competences for SD will not be integrated thoroughly into the curriculum, but in a rather "unconscious" way or "as a side-effect" (Lambrechts et al., 2012).

3.3. Acquiring competences for SD

The acquisition and assessment of competences for SD require different ways of teaching and learning (Sterling 2004, Wals en Jickling 2002), which focus on experiential learning, reflective learning, participative learning, active learning, creativity, collaboration, problem solving, practice-based learning, transdisciplinary approach and self-regulation. In other words, 'business as usual' is not an option for higher education (Tilbury and Mulà, 2011).

A multitude of learning methods, techniques and tools are described to teach and assess competences for sustainable development (e.g. Ceulemans and De Prins, 2010, Scoullos and Malotidi, 2004, Steiner and Posch, 2006, McKeown 2002, Lambrechts et al., 2009, Peeters, 2010). Analysis of these methods showed that there are three main characteristics of teaching and learning methods for competences for SD (Lambrechts et al., 2012):

- interactive and participative methods: e.g. Socrates method, group discussion, role play, group or personal diary, brainstorming, peer assessment, etc.;
- action oriented methods: e.g. learning through internships, solving real community problems, outdoor education, etc.;
- research methods: e.g. bibliographic research, problem analysis, value clarification, case studies, concept mapping, etc.

During the past years, research methods in education and research competences gained a lot of importance within higher education, independently from the concept of competences for SD. There is however little information about the contribution of research competences to better prepare students to the complexity and uncertainty of sustainability issues.

4. Research competences and research-based learning methods

4.1. Defining research competences

Research competences can be described in various forms, depending on the specific purpose or discipline in which they are used. Generally, higher education integrates research competences for two reasons: (1) to acquire "instrumental" research skills ("doing research"), (2) to acquire a critical and reflective "research attitude". Also, a lot of attention is paid towards information competences, sometimes seen as an important part of research competences, sometimes seen as a different concept, requiring different approaches in education. Generally, information competences or 'information literacy' can be described as the knowledge, insights, skills and attitudes necessary to: determine information needs; the efficient retrieval of relevant information; the evaluation; the effective and proper use of information; regardless of the medium (list defined within Education development project OOF2005/14 'Working on information skills with flexible usable learning objects').

Information competences are generally focused on documentary information, i.e. information that is recorded in documents in the broadest sense of the word (including digital information). Other information skills, related to data collection are often disciplinary oriented and defined, e.g. information through observation or through laboratory research (OOF2005/14). Research competences, in the strictest sense of the word, are the integrated knowledge, skills and attitudes to formulate a research question; defining a research design; selecting appropriate research methods; systematic reporting of research results (list defined within Education development project OOF2006 'Integration of Research in Education'). This description is merely focusing on instrumental research competences ('doing research'), but other components also have to be considered within the concept of research competences. Verburgh et al. (2008) describe six "research-related goals addressed in a given education profile":

1. acquire knowledge of results of research;
2. understanding the methodological substructure of results of research;
3. developing instrumental research skills;
4. developing the competence to be a researcher (cf. definition in the strict sense);
5. developing a critical attitude towards knowledge and knowledge construction;
6. developing a curiosity concerning developments within the discipline.

In the past years, the integration of research competences in higher education became a hot topic. More and more, the importance of integrating information and research competences is stressed,

not only for academic programs, also for professional (bachelor) programs, and even in secondary education. In Belgium, these competences are integrated in the specific end terms of secondary education, and are also focusing on instrumental research competences (Van Woensel, 2005). In The Netherlands and in Flanders, the specific end terms in secondary education are mainly focused on the acquisition of instrumental research competences, in order to prepare students for further studies in higher education (Stokking en Van der Schaaf, 1999, Van Looy en Elias (red.), 2007). It is clear that integrating research competences can focus on different goals, depending on the context of education. Table 2 gives an overview of different goals to integrate research competences (based on Stokking en Van der Schaaf, 1999).

Table 2. Goals to integrate research competences (Based on Stokking en Van der Schaaf, 1999)

Description of the goal	Characteristics	Final goals
1. Students doing research, as a form to further develop their knowledge about a given subject	≠ learning how to do research = inquiry-based learning	Acquire knowledge on a given topic
2. Students doing research, to motivate them to actively examine a subject in depth and/or have them work and learn independently	= inquiry-based learning = linked with other competences (e.g. cooperation)	Learning how to learn
3. Students gain knowledge of what research is about: the language, the way of reasoning, commute between theory, research question, research design, data and conclusion	= learning how to do research	Acquire knowledge on how to do research
4. Students gain experience in certain skills connected to research	= learning how to do research	Acquire certain specific research skills
5. Students become acquainted with the tools of a researcher	= learning how to do research	Acquire knowledge on doing research
6. Students become acquainted with the 'ethos' of research (e.g. critical attitude, curiosity, objectivity, etc.)	= learning how to do research = linked with general education	Attitude development
7. Students understand that knowledge is developed by people	= learning how to do research = linked with general education	Attitude development

The literature points out that there is a lot of discussion about the definition and formulation of research competences. Different definitions and frameworks were used in order to analyse the integration of research competences. Verburgh et al. (2008) use the term “research related goals” when developing a model to analyse the integration of these research related goals in Flemish study programs. Defining a university college wide competence “doing research” for the Hogeschool van Arnhem en Nijmegen (HAN) in the Netherlands, Jansen en ter Heine (2007) divided the information- and research competences into different levels from professional bachelor to PhD level, with a clear focus on instrumental research skills. Also within secondary education, information- and research competences are defined with a clear focus and within the framework of instrumental research skills, leading to the acquisition of these skills but not necessarily to the acquisition of a research-based attitude (Van Looy and Elias, 2007). Moreover, Stokking and Van der Schaaf (1999) state that the different research steps can be linked to the competences to be acquired.

4.2. Positioning research competences and competences for SD

The debate about key competences for SD is mainly focusing on how these competences can be defined and integrated in higher education curricula. However research-based education methods are seen as adequate ways to acquire competences for SD, little attention is given towards the actual consequences of this type of learning, and of the actual contribution of research-based learning to acquire competences for SD.

Setting the focus of the key competences, based on eight reported overviews of key competences for SD in peer-reviewed literature, and influenced by literature on sustainability science, Wiek et al. (2011) position five key competences for SD to converge towards a comprehensive key competence, the "sustainability research and problem-solving competence". This comprehensive key competence integrates the five key competences: systems-thinking competence, anticipatory competence, normative competence, strategic competence, and interpersonal competence. Furthermore, research is seen as a basic capacity, that, along with other basic capacities (e.g. critical thinking, communication, etc.) serve as a foundation for ESD within higher education, as the authors state "there is no doubt about the necessity of building these distinguished competencies in conjunction with "regular" or basic competencies conveyed in academic education" (Wiek et al., 2011, p. 211).

Brundiers et al. (2010) call for real-world learning opportunities to enable students to acquire key competences for SD. Three clusters of key competences are identified, the strategic knowledge cluster; the practical knowledge cluster; the collaborative cluster. It is within this last cluster that "facilitating participatory research" is seen as an important aspect. Moreover, the authors state that real-world learning opportunities could enhance students' research skills.

Within a case study on lecturers' perspectives on ESD in higher education reported by Cotton et al. (2009), one of the main constraints turned out to be the conflict with 'conventional' higher education pedagogies. Interviewed lecturers said to have a clear preference for student-centered and interactive pedagogies over passive lectures. However, research-based methods did not appear in the results of this study (Cotton et al., 2009).

It seems that the debate on acquiring competences for SD is looking at the role of research methods and research competences from different angles. In some cases, key competences for SD should be based on general competences, such as research; other cases state that learning methods to acquire competences for SD (such as real-world learning) help enhance students' research skills; further cases point to research-based teaching methods can contribute to the acquisition of competences for SD.

It is clear that the acquisition of competences for SD could benefit from using research based teaching and learning methods. The following chapters in this paper focus on particular research competences, their link with competences for SD, and their integration within the context of Leuven University College (KHLeuven), a Belgian university college offering professional bachelor programs in Business studies, Teacher training, Social work, Health care and Technology.

5. Case: defining research competences for professional bachelor programs in KHLeuven

With the purpose of integrating research in education, Leuven University College (KHLeuven) wanted to analyse the current situation of the integration of research in all study programs. However, most of the available models are described and structured with a focus on instrumental skills, and/or they are defined on a general level, thus overlooking a lot of differentiated elements of values, attitudes and insights. It is clear that the defining and analysis of research competences suffers from the general problem that they are defined and interpreted in a rather instrumental way, narrowing down the focus to skills, and omitting values, attitudes and insights.

Given this constraints, and in an effort to integrate competences in a value-based framework (Hermans, 2007), KHLeuven defined a complete set of information and research competences, comprising both instrumental skills and value-based attitudes. This set of competences was used to analyse the integration of research within all study programs in the four departments of KHLeuven.

5.1. A framework to define and integrate research competences at KHLeuven

KHLeuven is a middle sized HEI in Belgium, and offers professional bachelor programs business studies, teacher training, social work, health care and technology. Within KHLeuven, the debate about the integration of research into education evolved around two axes. The first axe focused on introducing research competences in the curriculum, with the purpose to enable students to acquire these competences. Both intstrumental competences ("learning how to do research") as competences oriented towards values and attitudes ("learning to act and reflect in a critical way") are envisioned within this axe. The second axe strived towards making a practical and physical link between research and education, by means of introducing researchers in the curriculum (through lectures and courses), and by introducing students in research projects (by allowing them to do parts of the research). It is clear both axes correlate to each other and may strengthen each other in achieving the goals, and enables using student-centered or teacher-centered, passive or active learning methods.

KHLeuven opted to define a set of competences, still structured within the framework of a research process with different research steps, but comprising both instrumental skills and value-based attitudes. The result is an integrated model of information and research competences, taking into account the true concept of competences, thus comprising knowledge, attitudes, values, skills and insights. Table 3 gives an overview of the information and research competences as defined by KHLeuven. In the table, competences focused towards acquiring research related attitudes are marked with the symbol (†). Information competences are seen as an integral part of this set of competences, however in the table they are marked with the symbol (*).

Table 3. Research competences at KHLeuven (based on Lambrechts and Vanhoren, 2009)

Competence I. Acquiring disciplinary knowledge in a multi-, inter-, and transdisciplinary framework
I.1. Use disciplinary and professional concepts
I.2. Develop a curiosity concerning developments within the discipline (†)
I.3. Acquire knowledge and insights in the scope and results of research
I.4. Understanding the methodological approach of research regarding the own discipline
I.5. Read and understand relevant Dutch and international (English or other foreign language) research literature
I.6. Be able to interpret the developments within the own discipline in a multi-, inter-and transdisciplinary framework
Competence II. Formulating a research question
II.1. Recognize, orient and formulate a problem
II.2. Differentiate and formulate research questions, hypotheses and expectations
II.3. Formulating objectives and establishing links between already acquired knowledge and research questions, hypotheses and expectations (†)
II.4. Mapping of the various direct and indirect stakeholders
Competence III. Defining a research plan
III.1. Making a research design with (sub-)activities necessary to find an answer to the research questions
III.2. Define a realistic plan of action
III.3. Define a communication plan addressed to the various direct and indirect stakeholders
III.4. Follow-up of the planning and revise if necessary (†)
III.5. Work in an effective way and respect deadlines (†)
Competence IV. Collect, select and organise information, data and suitable source material *
IV.1. Identifying information needs, the type and scope of the necessary information *
IV.2. Be familiar with the variety of (scientific) (primary and secondary) sources of information and of the various methodical possibilities to gather these resources * (†)
IV.3. Select relevant information sources *
IV.4. Efficient data collection and relevant information, be familiar with databases for searching information, be able to find relevant literature *
Competence V. Determine the relevance, value, usefulness and representativeness of the obtained information, data and data sources, and using them correctly
V.1. Develop a critical attitude towards information, knowledge and knowledge construction * (†)
V.2. Be aware of the importance of reliable scientific information *
V.3. Critically evaluate and effectively, correctly and appropriately use the collected or generated information, regardless of the medium *
V.4. Handle sources in an integer way (†)
Competence VI. Processing data
VI.1. Be able to select appropriate methods and techniques for the processing of data
VI.2. Analyse data
VI.3. Interprete date
Competence VII. Drawing reasoned and argued conclusions
VII.1. Using new or original information in order to construct new concepts and insights * (†)
VII.2. Formulate conclusions
VII.3. Formulate recommendations
Competence VIII. Evaluate and assess the research
VIII.1. Be prepared to question each act or choice in the research process, both content related and methodological (†)
VIII.2. Critically evaluate the search for information *, the processing of data and formulation of conclusions (†)
VIII.3. Critical reflection on the quality of the performed research, of the own work and of the learning experiences (†)
VIII.4. Reflect on the analysis and judgement of complex issues taking into account social, scientific and ethical aspects (†)
Competence IX. Determine and argue a (own) position or opinion
IX.1. Use of information and research data taking into account cultural, ethical, economic, social, ethical and ecological standards and values * (†)
IX.2. Listen to and respect the opinions of others (†)
IX.3. Determine a reasoned own point of view, both in relation to the topic of research as the research process itself (†)
Competence X. Systematically report about (describe) and present (transfer)
X.1. (Interim) oral and/or written reporting to stakeholders
X.2. Proper use of references *
X.3. Presenting research results in a clear and logical structure, including correct (Dutch) language use

5.2. Current integration of research competences at KHLeuven

The framework of research competences was used in KHLeuven to make an empirical, qualitative analysis of the extent of integration of these research related competences within the study programs of KHLeuven, based on two research questions:

- Which competences focused on acquiring a research related attitude are integrated in the study programs, and to what extent?
- Which instrumental research competences are integrated in the study programs, and to what extent?

The hypothesis is that competences can be integrated implicitly or explicitly. An implicit integration means that a given competence is not mentioning research, but indirectly contributes to research related competences. An explicit integration means that research competences are mentioned explicitly in the study program, focusing on the acquisition of these research competences. The analysis was done by a research assistant and the central research coordinator, based on competence schemes of all study programs. After the analysis, focus groups were organized for each study program, in order to gather feedback on these results from lecturers, policy members and students. After these focus groups, each study program was able to further work on the integration of research competences, based on the framework and the results of the analysis. The general results of the analysis were described in an internal report (Lambrechts and Vanhoren, 2009).

The defined research competences are structured according to the different steps in a research process. The analysis indicates that certain information and research competences are pertinently present. However, there are also clear gaps. The competence cluster VII (Drawing reasoned and argued conclusions) and cluster IX (Determine and argue a (own) position or opinion) are barely covered within the study programs. Competences focused towards acquiring a particular research based attitude remain scarcely integrated into the competence schemes. Information literacy (cluster IV and V) is not or barely addressed in the competence schemes of the different bachelor programs, as is competence X.2. "proper use of references". This is, given the growing attention towards information competences, a rather alarming observation.

Information and research competences are integrated in the competence schemes of the different study programs both implicit and explicit. Explicit elements are often focused on particular aspects of instrumental research skills, however only integrating aspects partially and fragmented, e.g. include data analysis, but not mentioning reporting. Implicit elements are more focused towards acquiring a research based attitude, e.g. critical reflection when performing a particular task, without acquiring instrumental research competences.

All bachelor programs integrate a combination of instrumental research skills and competences focused on acquiring a research based attitude. Both types are present to a greater or lesser degree, depending on the study program. Within the 'exact' Sciences (e.g. chemistry, biomedical laboratory sciences) there is more attention to instrumental research skills (data analysis), while in the 'human' Sciences (eg. teacher training, business studies) acquisition of a research based attitude is considered more important.

5.3. Elements of SD in the framework of KHLeuven

Looking at the framework of information and research competences of KHLeuven from the perspective of key competences for SD, several aspects can be identified. These elements are shown in table 4. It is clear that the main research competences focusing on acquiring attitudes could contribute considerably to the acquisition of competences for SD. However, there is no explicit link towards SD. In order to actually contribute to competences for SD, these research competences should be framed and positioned within the concept of SD. Without this explicit link towards SD, the contribution will merely be minimal.

Table 4. Elements of key competences for SD in the framework of research competences

Competence I. Acquiring disciplinary knowledge in a multi-, inter-, and transdisciplinary framework
I.6. Be able to interpret the developments within the own discipline in a multi-, inter-and transdisciplinary framework
Competence II. Formulating a research question
II.4. Mapping of the various direct and indirect stakeholders
Competence III. Defining a research plan
III.3. Define a communication plan addressed to the various direct and indirect stakeholders
Competence V. Determine the relevance, value, usefulness and representativeness of the obtained information, data and data sources, and using them correctly
V.1. Develop a critical attitude towards information, knowledge and knowledge construction * (†)
Competence VIII. Evaluate and assess the research
VIII.1. Be prepared to question each act or choice in the research process, both content related and methodological (†)
VIII.2. Critically evaluate the search for information *, the processing of data and formulation of conclusions (†)
VIII.3. Critical reflection on the quality of the performed research, of the own work and of the learning experiences (†)
VIII.4. Reflect on the analysis and judgement of complex issues taking into account social, scientific and ethical aspects (†)
Competence IX. Determine and argue a (own) position or opinion
IX.1. Use of information and research data taking into account cultural, ethical, economic, social, ethical and ecological standards and values * (†)
IX.2. Listen to and respect the opinions of others (†)
IX.3. Determine a reasoned own point of view, both in relation to the topic of research as the research process itself (†)

Table 4 only shows the research competences that could directly and explicitly be linked to competences for SD. In order for other (also instrumental) research competences could indeed contribute to acquiring competences for SD, but in order to make this process successful, some specific conditions have to be taken into account:

- Instrumental research skills can indeed contribute to acquiring competences for SD, but there's a need to frame these competences within the concept of SD;
- Particular attention needs to be drawn towards competences focusing on attitude development, and more specifically the ethical perspectives inherent to SD;
- Information literacy also needs to be reframed within the concept of SD, as sustainability issues are characterised by complexity, multiple information sources, contradictory information, changing information over time, etc.

6. Discussion

The general attention towards competence-based higher education is leading to extended debate about the characteristics of such education and about the practical implications when integrating this into existing study programs. First, the competence concept has become too elastic and too blurry, due to mixed interpretations and expectations. Second, and as a result of this, the competence concept is integrated inappropriate into existing study programs, often leading to a mix of using competences in the 'old' system of courses and modules, and resulting in weak or wrong outcomes. Third, competences are criticised because of the 'instrumental' translation made by higher education policy and lecturers: competences should be defined in a way that allows them to be assessed, often leading to mere skill acquisition and omitting values and attitudes, as these are hard to assess. Within the case of KHLeuven, particular attention has been given towards framing the competences within general values. However, the analysis of the different study programs pointed out that the practical integration of the competences was often focused on instrumental skills rather than values and attitudes.

It is clear that the concept of key competences for SD suffers from the same symptoms. As these competences have a strong focus on complexity, interconnectedness, values and attitudes, it is particularly hard to deal with them. In the past years, a lot of sets and frameworks for key competences for SD were defined, however their integration is still too fragmented, implicit, or focused towards instrumental skills, and the specific outcomes of these competences is hard to measure. Also within the case of KHLeuven, it seems there is a mismatch between the study programs intentions (framing competences in values) and the practical situation, where there is no framing of the competences within the concept of SD.

Furthermore, (instrumental) research skills and research-based methods are mentioned in the literature to serve as a basis to acquire competences for SD. However, there is no specific focus on how these research competences could contribute to acquire key competences for SD, or the specific implications this argument has for higher education. The case of KHLeuven indeed shows that, within the research competences framework, there are a lot of competences available which could theoretically contribute to acquire competences for SD, however without explicitly framing these competences within the SD concept, and making the link with competences for SD, their contribution will rather be a side-effect of the learning process.

Throughout the years, considerable attention has been paid to research competences and their integration in higher education, independently from the concept of SD. Within the concept of 'integration of research and education', the debate is focusing on two aspects: enable students to acquire (instrumental) research competences on the one hand, better translate research results into education on the other hand. However, due to the same discussion on the competence concept, the integration of research competences is too fragmented, too implicit, and too much focused towards acquiring and assessing instrumental skills. Also within the case of KHLeuven, the research competences are integrated rather fragmented, and not as a result of a planned and structured process.

Research competences and research-based learning methods could contribute to the acquisition of key competences for SD, if two basis conditions are taken into account. The first condition is to define research competences within the framework of SD, e.g. by focusing on interdisciplinary and transdisciplinary approach, stakeholder involvement, systems-thinking approach and anticipatory thinking. The second condition calls for particular attention towards values and attitude development, also within the framework of SD. A lot of elements are already introduced in higher education curricula, e.g. critical reflection, however not connected to the SD concept.

7. Conclusions

This paper started from the discussion on key competences for SD, their definition and the implications of integrating them into higher education. Traditional teaching methods, based on rather passive lecturing and focused on transmission of knowledge, is insufficient to acquire key competences for SD. There's a clear preference for active, student-centered and real-world learning methods. Within the literature, research-based methods are also mentioned, mainly as a way to support other learning methods, and not as a proper methods to acquire competences for SD.

Giving the complexity of SD issues, it could however be relevant to analyse the role and contribution of research competences and research-based methods. This paper looked at the definition and integration of research competences within KHLeuven, a Belgian higher education institution. The reason to do this was that KHLeuven did pay considerable attention in analysing both competences for SD and research competences, and information about both types of competences was available within all study programs of the HEI.

The case pointed out that (instrumental) research competences are necessary in order to contribute to handling SD issues, while competences oriented towards attitudes are contributing to acquire values and attitudes inherent to SD. However, research competences, both in their instrumental form as their attitudinal form, are poorly integrated within the study programs: too implicit and too fragmented. This is a clear result from the fragmented interpretation and integration of the general competence concept in higher education. Furthermore, there's a need to (re-)frame the research competences within the concept of SD, in order to truly contribute to the acquisition of competences for SD.

8. References

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